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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/766,618	01/27/2004	Yoshihide Senzaki	A-70028-1/MSS/TJH (463035)	3758
32940	7590	11/25/2005	EXAMINER	
DORSEY & WHITNEY LLP 555 CALIFORNIA STREET, SUITE 1000 SUITE 1000 SAN FRANCISCO, CA 94104			NGUYEN, HA T	
			ART UNIT	PAPER NUMBER
			2812	

DATE MAILED: 11/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

2

<b>Office Action Summary</b>	<b>Application No.</b> 10/766,618	<b>Applicant(s)</b> SENZAKI, YOSHIHIDE	
	<b>Examiner</b> Ha T. Nguyen	<b>Art Unit</b> 2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 08 September 2005.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,3,4,6,8 and 10-15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3,4,6,8 and 10-15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

1. Applicant's Amendment and Response to the Office Action mailed 5-4-5 has been entered and made of record.

#### *Claim Rejections - 35 USC § 112*

2. Claims 8 and 12 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 8 depends from cancelled claim 7 and claim 12 recites Zr-Si-O and Hf-Si-O in line 2. This limitation is conflicting with the requirements of claim 10, upon which it depends, because in Zr-Si-O and Hf-Si-O y is equal to 1 while claim 10 requires y to be in the range of 2 to 5.

#### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 3-4, 6, 8, 10-15 are rejected under 35 U.S.C. 102(e) as being unpatentable over Callegari et al. (USPN 6664186, hereinafter "Callegari"), in view of Steigerwald et al. (USPN 6479404, hereinafter "Steigerwald").

Referring to Figs. 12A-12H and related text, Callegari discloses [Re claim 1] a method of forming a multilayer dielectric film on a substrate, comprising the steps of: forming a metal silicate layer on the surface of the substrate; forming a metal oxide layer atop the metal silicate layer, said metal oxide is selected from the group consisting of  $ZrO_2$  and  $HfO_2$ ; and forming another metal silicate layer atop the metal oxide layer, wherein said metal oxide layer has a

dielectric constant  $k$  and Callegari also implied that said metal silicate layer has a dielectric constant lower than the dielectric constant of said metal oxide layer because, layer 56 of metal oxide has high dielectric constant while the other two may not; [Re claim 8] wherein said metal oxide includes more than one metal element; [Re claim 10] wherein said metal silicate has the formula of  $M_xSiO_y$ , where  $M$  is a metal selected from the group consisting of Zr, Hf, Ti, V, Nb, Ta, Cr, Mo, W, Mn, Zn, Al, Ga, In, Ge, Sr, Pb, Sb, Bi, Sc, Y, La, Be, Mg, Ca, Sr, Ba, Th, Lanthanides (Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu), and mixtures thereof,  $x$  is a number in the range of 1 to 3, and  $y$  is a number in the range of 2 to 5; [Re claim 11] wherein said metal silicate includes more than one metal element (see Example 5).

But it fails to disclose expressly [Re claim 3] wherein said forming steps are carried out by any one of, or combination of, chemical vapor deposition (CVD), physical vapor deposition (PVD), atomic layer deposition (ALD), aerosol pyrolysis, spray coating or spin-on-coating; [Re claim 4] said forming steps are carried out by chemical vapor deposition (CVD) and using an oxygen source selected from the group consisting of  $O_2$ ,  $O_3$ , NO,  $N_2O$ ,  $H_2O$ ,  $OH^-$ , alcohol, alkoxides, and  $H_2O_2$ ; and [Re claim 6] wherein said metal oxide layer has a dielectric constant in a range of 15 to 200 and said metal silicate layer has a dielectric constant in a range of 5 to 100.

However, the missing limitations are well known in the art because Steigerwald discloses these features (See par. bridging cols. 5-6, and col. 5, lines 38-55). Note that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists (See MPEP 2144.05).

A person of ordinary skill is motivated to modify Callegari with Steigerwald to obtain gate dielectric having high dielectric constant.

[Re claim 12] Callegari fails to disclose expressly wherein said metal silicate is selected from the group consisting of Zr-Si-O and Hf-Si-O. However, it discloses the use of Zr and Hf silicates which include Zr-Si-O and Hf-Si-O (see Example 5); and

[Re claim 13] wherein said metal silicate layer has a thickness smaller than a thickness of said metal oxide (see Figs. 12F-12H).

[Re claims 14-15] Callegari fails to disclose wherein said metal oxide layer has a thickness in a range of about 30 to 80Å or wherein said second metal silicate layer has a thickness of one to two atomic layers. However, it would have been obvious to an ordinary

Art Unit: 2812

artisan to use the appropriate thickness for the layers to meet the requirements of a specification concerning leakage current, quality and cost.

Therefore, it would have been obvious to combine Callegari with Steigerwald to obtain the invention as specified in claims 1, 3-4, 6, 8, and 10-15.

### ***Response to Amendment***

5. In view of applicant's cancellation of the claims 2, 5, 7, and 9, the rejection of claims under 35 U.S.C. 102 or 103, as stated in the immediately preceding Office Action, is rendered moot.

In view of applicant's amendment to the claim, the rejection of claim 1 under 35 U.S.C. 102, has been withdrawn.

Applicant's arguments with regard to the rejections under 35 U.S.C. 103 have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

Applicants mainly argued that Callegari does not teach or suggest a metal oxide layer of composition other than Al oxide. The examiner disagreed, Callegari teaches a multi layer metal oxide with at least one layer of Al oxide and additional layers of other metal oxides including HfO<sub>2</sub> and ZrO<sub>2</sub> (see col. 11, lines 40-54). The claims do not preclude the existence of a layer of Al oxide because the use of an open- ended term "comprising" allows for additional steps to be performed including the step of forming an Al oxide layer.

Applicant also argued the lack of motivation to combine Callegari with Steigerwald. The examiner disagreed. Both method are to form high dielectric constant gate dielectric, Callegari is silent about how to form the metal oxide while Steigerwald, complementing Callegari, discloses the details about the formation of the metal oxide. The motivation to combine is to obtain high dielectric constant gate dielectric in a proven process.

Therefore, the combined teaching of Callegari and Steigerwald does teach or make obvious all the limitations of the rejected claims 1, 3-4, 6, 8, and 10-15.

### ***Conclusion***

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

Art Unit: 2812

A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha T. Nguyen whose telephone number is (571) 272-1678. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week. The telephone number for Wednesday is (703) 560-0528. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael S. Lebentritt, can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Ha Nguyen

Primary Examiner

11- 18- 05